REMARKS

This amendment responds to the Office action dated March 15, 2007.

The examiner has objected to the drawings under 37 C.F.R. §1.83(a) as failing to show every feature of the invention specified in the claims. New figures 3-5 are added in response to this objection and are attached as Appendix A.

The examiner has objected to claim 10 as the word “colorbalance” should be hyphenated. Claim 10 has been amended to correct this error.

The examiner has objected to claim 9 as the word “than” was misspelled as “that.” Claim 9 has been amended to correct this error.

Claim 9 has been rejected under 35 U.S.C. §112, second paragraph as being indefinite due to a lack of antecedent basis. Claim 9 has been amended to correct this error.

Claim 13 has been rejected under 35 U.S.C. §101 as being directed to non-statutory subject matter. Claim 13 has been amended as a computer readable media claim to overcome this rejection.

Claims 1-2, 4-7 and 9-13 are rejected under 35 U.S.C. §102 as being anticipated by Finlayson et al, “Color by Correlation: a simple, unifying framework for color constancy,” IEEE Trans. Pattern Analysis and Machine Intelligence, vol. 23, pp 1209-1221, 2001.

Claim 3 has been canceled, but has been rewritten in independent form as new claim 14.

Applicant argues that this rejection is improper as it fails to present a prima facie case of anticipation. Finlayson et al do not teach the element of “fitting a surface to a plurality or match scores, said surface representing illuminant values other than said candidate illuminants.” nor does Finlayson et al teach the element of “determining a point on said surface … corresponding to data representing a likely illuminant.” Finlayson et al teach a method wherein they determine a correlation matrix of probability distribution for probable illuminants. The correlation matrix is applied to the image and the illuminant with the highest correlation is selected as the image illuminant. Finlayson et al do not teach fitting a surface to match scores, wherein the surface represents illuminant values other than the candidate illuminant values. While Finlayson may calculate values similar to the match scores of the present invention, Finlayson et al do not teach fitting a surface to those scores nor does Finlayson et al determine a point on that surface. The surface described in these claims represent illuminant other than the candidate illuminants because the surface is fitted to those point and effectively interpolates between them. Finlayson et al teach only selection from among the candidate illuminants and do not teach calculating a point that may fall between those candidate illuminants on the surface of the present claims.

Claims 2 and 4-9 are dependent on claim 1, comprise all the limitation therein, and are patentable for the reasons stated above in relation to claim 1.

Claim 9 further comprises the element of “solving for the color coordinates of an extremum on said surface.” As Finlayson et al do not teach the surface, they cannot teach

solving for an extremum thereon. Accordingly, claim 9 comprises a further patentable element beyond those mentioned in relation to claim 1.

Claims 10-14 comprise the same or similar elements to those of claim 1. These claims describe a surface representing illuminant values other than the candidate illuminant values and the determination of a point on that surface. As described above in relation to claim 1, these element are not taught in Finlayson et al. Accordingly, these claims are patentable for the reasons stated above in relation to claim 1.

Claims 1 and 5 are rejected under 35 U.S.C. §102 as being anticipated by Brainard et al, "Bayesian Color Constancy," J. Optical Soc. Am. A, vol. 14, pp 1393-1411, 1997.

The rejection also fails to present a prima facie case of anticipation as it does not teach the elements of "fitting a surface to a plurality or match scores, said surface representing illuminant values other than said candidate illuminants." for does Finlayson et al teach the element of "determining a point on said surface … corresponding to data representing a likely illuminant." While Brainard et al teach methods that achieve functions similar to the claimed invention and Brainard et al show many three-dimensional plots of probability functions, Brainard et al do not teach fitting a surface to match scores or using that surface to determine a point corresponding to a likely illuminant. These elements are found in claims 1 and 5. Applicant respectfully requests reconsideration of this rejection and allowance of these claims.

Claim 8 is rejected under 35 U.S.C. §103(a) as being unpatentable over Finlayson et al.

This rejection is improper as it fails to present a prima facie case of obviousness. Finlayson et al do not teach fitting a surface to the match points. A surface is a mathematical

construct that spans between illuminant values, hence the surface represents illuminants other than the candidate illuminants. The methods of Finlayson et al consider only the candidate values in their matrix and do not construct a surface fitted to those values. As claim 8 claims these elements, it is allowable for the reasons stated above in relation to claim 1 and other claims. Applicant respectfully requests reconsideration of this rejection and allowance of this claim.

The examiner has indicated that claim 3 would be allowable if rewritten in independent form. Claim 3 is canceled and rewritten in independent form as claim 14.

In light of the arguments above, all claims are considered to be novel, non-obvious and patentable in view of the cited art. The applicant respectfully requests that the examiner reconsider the rejections of these claims. The examiner is invited to contact applicant's attorney directly for any reason.

Respectfully submitted,

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APPENDIX A

[06] The present embodiments will become more fully apparent from the following description and appended claims, taken in conjunction with the accompanying drawings. Understanding that these drawings depict only typical embodiments and are, therefore, not to be considered limiting of the invention's scope, the embodiments will be described with additional specificity and detail through use of the accompanying drawings in which:

Fig. 1a is a diagram illustrating a set of candidate illuminants as x-y chromaticity coordinates;

Fig. 2 is a diagram of an exemplary match score surface;

Fig. 3 is a flow chart showing a method of embodiments of the present invention comprising forming an illuminant set;

Fig. 4 is a flow chart showing a method of embodiments of the present invention comprising forming a design matrix; and

Fig. 5 is a flow chart showing a method of embodiments of the present invention comprising forming a matrix of monomial basis functions.

[10] An exemplary match surface is shown in Figure 2, which is a plot of x and y chromaticity and the match score. In this plot, the chromaticity of each candidate or model illuminant is plotted on the horizontal axes while the vertical axis represents the likelihood of being the image illuminant or match score. In some embodiments, illustrated in Figures 3, 4 and 5, a fixed set of illuminants 30, which may or may not occupy a conventional grid, identifies the horizontal position of a point of the match surface. An analysis 31, 41, 51 of each illuminant in the fixed set with respect to image data then identifies the z-axis coordinate of the surface point. Once the surface points are identified, an analytic form may be matched 32, 42 and 52 to the surface. In some embodiments, we may assume an over-determined system. In some embodiments and for some image types, a quadratic form works well, however, other orders of surfaces, such as cubic and quartic may be used.

[15] Generally steps 1 and 2 will be performed offline, however, they may be performed online as well when resources and time constraints allow.

3) Form the design matrix 40 for the predetermined set of model illuminants, based on each model's chromaticity coordinates. This can be a matrix of monomial basis functions 50 in the chromaticity coordinates of each illuminant. For a quadratic form it is defined as follows:

$$\mathbf{A} = \begin{bmatrix} x_1^2 & x_1 y_1 & y_1^2 & x_1 & y_1 & 1 \\ x_2^2 & x_2 y_2 & y_2^2 & x_2 & y_2 & 1 \\ & & \vdots & & & \\ x_n^2 & x_n y_n & y_n^2 & x_n & y_n & 1 \end{bmatrix}$$

4) Compute the Moore-Penrose pseudoinverse of the design matrix. For a quadratic form this is a $6 \times N$ matrix where N is the number of illuminant models. It is defined as:

$$\mathbf{\Sigma} = \left(\mathbf{A}^{\mathrm{T}}\mathbf{A}\right)^{-1}\mathbf{A}^{\mathrm{T}}$$

APPENDIX A

Replacement drawings 3-5 are attached on the following sheets.